(19)THE KOREAN INTELLECTUAL PROPERTY OFFICE (KR)
(12) Korean Patent Publication (A)

(51) Int. Cl.
H01J 17/49

(11) Korean Patent Publication number: 10-2002-0027801 A
(43) Date of publication of application: April 15, 2002

(21) Application number: 10-2000-0058479
(22) Date of filing: October 5, 2000

(71) Applicant: SAMSUNG SDI CO., LTD.

(72) Inventor(s): HWANG, YONG UN
MO, BU GYEONG

(54) TITLE OF THE INVENTION:

PLASMA DISPLAY PANEL

【ABSTRACT OF THE DISCLOSURE】

【Abstract】

The present invention relates to a plasma display device for efficiently dissipating heat generated in the plasma display device, guaranteeing reliability of a circuit element, increasing a life-span of the plasma display device, and providing a pleasant watching environment. In addition, the plasma display device according to an exemplary embodiment of the present invention includes a plasma display panel (PDP), a frame chassis mounted on the PDP, at least one circuit board mounted on the frame chassis, at least one heat sink coupled to the respective circuit boards, a cover for covering respective components,

and at least one thermoelectric element having a terminal mounted on the respective heat sinks and another terminal exposed to the exterior through the cover.

【Representative Drawing】

Representative drawing: FIG. 2

【SPECIFICATION】

【BRIEF DESCRIPTION OF THE DRAWINGS】

FIG. 1 shows a side view of a plasma display device using a conventional heat dissipating device.

FIG. 2 shows a side view of a plasma display device according to an exemplary embodiment of the present invention, in which a thermoelectric element is used as a heat dissipating device.

FIG. 3 shows a side view of the plasma display device according to another exemplary embodiment of the present invention, in which a heat pipe is used as the heat dissipating device.

* Description of Reference Numerals Indicating Primary Elements in the Drawings *

11, 21, 31 : Plasma Display Panel (PDP).

12, 22, 32 : Frame Chassis.

13, 23, 33 : Circuit Board.

14, 24, 34 : Circuit Element.

15, 25, 35 : Thermal Conductivity Rubber.

16, 26, 36 : Heat Sink.

17, 28, 38 : Cover.

18 : Grill.

27 : Thermoelectric element.

37 : Heat pipe.

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DESCRIPTION OF THE RELATED ART]

The present invention relates to a plasma display device. More particularly, the present invention relates to a plasma display device having a revised configuration so that heat generated in the plasma display device may be efficiently dissipated.

In general, a plasma display device (plasma display panel) is a device for displaying a desired image by exciting phosphors formed in a predetermined pattern by ultraviolet (UV) rays generated by a discharge voltage applied after gas is provided between two substrates including a plurality of electrodes.

The plasma display device is classified into a direct current type and an alternating current type according to a type of driving voltages (e.g., a discharge type) applied to a discharge cell, and is classified into an opposing discharge type and a surface discharge type according to an electrode configuration.

In the DC PDP, all electrodes are exposed to a discharge space, and electric charges are directly transferred between corresponding electrodes. In the AC PDP, at least one electrode is surrounded with a dielectric layer, and electric charges are not directly transferred between corresponding electrodes but rather the discharge is performed using wall charges.

When the above plasma display device is driven, a panel is heated to a temperature of 60 to 80 °C by gas discharges, or heat is generated from a circuit board. The heat generated in the plasma display device may deteriorate phosphor, electrode, and electromagnetic wave shield layers, and therefore it is required to reduce the temperature to a predetermined temperature.

FIG. 1 shows a side view of a plasma display device using a conventional heat dissipating device.

As shown in FIG. 1, the conventional plasma display device includes a plasma display panel (PDP) 11, a frame chassis 12 mounted on the plasma display panel (PDP) 11, a circuit board 13 mounted on the frame chassis 12, a circuit element 14 connected to the circuit board 13 and including a heat generating element, a heat sink 16 mounted on the circuit element 14, a thermal conductivity rubber 15 for connecting the circuit element 14 and the heat sink 16, and a cover 17 partially having a grill 18 and covering the above components. A fan 19 may be provided between the circuit board 13 and the cover 17 to circulate air in the plasma display device so that the heat may be efficiently dissipated by the heat sink 16.

In the plasma display device in the above configuration, the heat

generated in the plasma display panel (PDP) 11 and transmitted through the frame chassis 12 and the heat generated in the circuit element 14 are gathered in the heat sink 16, and are externally dissipated through the air between the circuit board 13 and the cover 17, and therefore the plasma display device may be prevented from being overheated. In addition, when the fan 19 is provided, the air circulation is facilitated between the circuit board 13 and the cover 17, and therefore the heat dissipation may be performed more efficiently.

However, since the heat in the heat sink 16 is dissipated to the exterior by the air circulation between the circuit board 13 and the cover 17 in the conventional plasma display device, heat dissipating efficiency is low, and a short-circuit may occur while the circuit element 14 is operating. In addition, when the fan 19 is provided to increase the air circulation, a noise occurs by operating the fan 19, and therefore a pleasant watching environment may not be provided.

【OBJECT TO BE ACHIEVED BY THE PRESENT INVENTION】

The present invention has been made in an effort to solve the above-described problem, and it is an object of the present invention to provide a plasma display device for directly dissipating heat generated in a plasma display panel (PDP) and a circuit element by thermoelectric elements, achieving reliability of the circuit elements, increasing a life-span of the plasma display device, increasing heat dissipating efficiency without using a fan, preventing a noise caused by the fan, and obtaining a pleasant watching environment.

[CONSTITUTION AND OPERATION OF THE INVENTION]

To achieve the above objects, a plasma display device according to an exemplary embodiment of the present invention includes a plasma display panel (PDP), a frame chassis mounted on the PDP, at least one circuit board mounted on the frame chassis, at least one heat sink connected to the respective circuit boards, a cover for covering the respective components, and at least one thermoelectric element having a terminal mounted on the respective heat sinks and another terminal exposed to the exterior through the cover.

In addition, the plasma display device further includes a temperature sensor mounted between the circuit board and the cover and electrically coupled to the thermoelectric element.

Further, the plasma display device includes at least one circuit element electrically coupled to the respective circuit boards, mounted on the respective heat sinks, and having a heat generating element among constituent elements of the circuit board.

In addition, the respective circuit elements are mounted on the respective heat sinks by using a thermal conductivity rubber.

An exemplary plasma display device according to an embodiment of the present invention includes a plasma display panel (PDP), a frame chassis mounted on the PDP, at least one circuit board mounted on the frame chassis, at least one heat sink connected to the respective circuit boards, a cover for covering the respective components, and at least one heat pipe having a

terminal mounted on the respective heat sinks and another terminal exposed to the exterior through the cover.

In addition, the plasma display device further includes at least one circuit element electrically coupled to the respective circuit board, mounted on the respective heat sinks, and having a heat generating element among constituent elements of the circuit board.

FIG. 2 shows a side view of a plasma display device according to an exemplary embodiment of the present invention.

As shown in FIG. 2, the plasma display device according to the exemplary embodiment of the present invention includes a plasma display panel (PDP) 21, a frame chassis 22 mounted on the plasma display panel (PDP) 21, at least one circuit board 23 mounted on the frame chassis 22, at least one heat sink 26 connected to each circuit board 23, a cover for covering the above components, at least one thermoelectric element 27 having a terminal mounted on each heat sink 26 and another terminal penetrated through the cover 28 to be exposed to the exterior.

The plasma display panel (PDP) 21 according to the exemplary embodiment of the present invention may be an alternating current type or a direct current type.

The frame chassis 22 is mounted on a rear surface of the PDP 21 by using a thermal conductivity adhesive, and is formed of materials having good thermal conductivity (e.g., aluminum).

The circuit board 23 is mounted on a surface of the frame chassis 22, and the PDP 21 is mounted on another surface of the frame chassis 22. One

or more circuit boards 23 may be provided.

One or more heat sinks 26 may be coupled to the respective circuit boards 23. The respective heat sinks 26 use a metal having excellent thermal conductivity, a terminal 26b in a planar shape is connected to the circuit board 23, and another terminal is required to have a perpendicularly extended part 26a, but the present invention is not limited thereto and is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

The cover 28 is formed in a planar shape and each edge is curved at a predetermined angle, and therefore the cover 28 is formed in a box shape without a top cover. A hole is provided on the cover so that the thermoelectric elements 27 may be exposed, and the edges of the cover 28 are respectively coupled to end portions of the PDP 21 and cover the above components to protect them. However, the shape of the cover 28 is not limited thereto, and the present invention covers various modifications within the spirit and scope of the appended claims.

In a configuration of the thermoelectric element 27 called a peltier chip, n-type and p-type thermoelectric semiconductors are electrically coupled in series and thermally coupled in parallel so that the thermoelectric element 27 is formed in a π shape. As a predetermined voltage is applied thereto, one surface of the thermoelectric element 27 absorbs the heat since the surface is cooled down, and another surface dissipates the absorbed heat. As shown in a magnified perspective view in FIG. 2, in the thermoelectric element 27, a cooling part 27a for absorbing the heat is provided on a rear surface of the

extended part 26a of the heat sink 26, and a heat dissipating portion 27b for dissipating the heat is disposed so that the heat dissipating portion 27b is exposed to the exterior of the plasma display device through the hole of the cover 28. One or more thermoelectric elements 27 may be provided to the respective heat sinks 26.

A plasma display device according to the exemplary embodiment of the present invention may further include a temperature sensor (not shown) electrically coupled to the thermoelectric element 27 and provided between the circuit board 23 and the cover 28.

Here, while the temperature sensor (not shown) is mounted at a predetermined position between the circuit board 23 and the cover 28, it may be provided to a position for sensing a temperature change in the plasma display device. The temperature sensor (not shown) may be electrically coupled to the thermoelectric element 27 through a device for converting the temperature change into an electric signal and transmitting the signal.

In addition, th e plasma display device according to the exemplary embodiment of the present invention may further include at least one circuit element 24 electrically coupled to the respective circuit board 23, mounted on the respective heat sink 26, and including a heat generating element of the circuit board 23.

Here, the respective circuit elements 24 include the heat generating element of the circuit board 23, a terminal thereof is electrically coupled to the circuit board 23 through a predetermined connection unit, and another terminal thereof is mounted on a predetermined part of the heat sink 26. However, the

respective circuit elements 24 are mounted on a surface opposite to a surface on which the thermoelectric element 27 is mounted, among the two surfaces of the extended part 26a of the respective heat sinks 26. The respective circuit elements 24 are mounted to the heat sink 26 by a thermal conductivity adhesion material, that is, a thermal conductivity rubber 25.

FIG. 3 shows a side view of the plasma display device according to another exemplary embodiment of the present invention.

As shown in FIG. 3, the plasma display device according to the other exemplary embodiment of the present invention includes a plasma display panel (PDP) 31, a frame chassis 32 mounted on the PDP 31, at least one circuit board 33 mounted on the frame chassis 32, at least one heat sink 36 coupled to the respective circuit boards 33, a cover 38 for covering the above components, and at least one heat pipe 37 having a terminal mounted on the respective heat sinks 36 and another terminal exposed to the exterior through the cover 38.

A configuration of the plasma display device according to the exemplary embodiment of the present invention shown in FIG. 3 is the same as that according to the above-described exemplary embodiment of the present invention shown in FIG. 2 except that the thermoelectric element is eliminated from the plasma display device and the heat pipe is provided. Accordingly, the heat pipe 37 will now be described, and detailed descriptions of other constituent elements will be omitted.

Condensed liquid is instilled into loop-type or non-loop type small tubes, and the small tubes are arranged in the heat pipe 37. A plug state

closing the small tube by a surface tension of the liquid is formed by a liquid part in the small tube, a vapor bubble state is formed by a vapor part formed by diffused vapor of the liquid, and the liquid and vapor parts are alternately or randomly disposed in parallel when the heat pipe 37 is not used. When the heat is absorbed and dissipated in the small tube, the liquid and the vapor bubble are actively moved (i.e., circulated or vibrated) since an parallel state is broken. Accordingly, without additionally providing external energy, heat transfer may be performed.

As shown in a magnified perspective view in FIG. 3, in the heat pipe 37, a heat absorbing unit 37a for absorbing the heat is mounted on a rear surface of an extended part of the heat sink 36, and a heat dissipating portion 37b is disposed so that the heat dissipating portion 37b may be exposed to the exterior of the plasma display device through a hole of the cover 38. The heat pipe 37 is formed by a serpentine heat pipe including a small serpentine tube formed in a plate including a material having good thermal conductivity, but the present invention is not limited thereto and is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. One or more heat pipes 37 may be mounted on the respective heat sinks 36.

The plasma display device according to the exemplary embodiment of the present invention may further include at least one circuit element 34 electrically coupled to the respective circuit board 33, mounted on the respective heat sink 36, and including a heat generating element of the circuit board 33.

Hereinafter, an operation of the plasma display device in the above configuration will now be described.

When the plasma display device begins to operate, the heat is generated by the plasma discharge in the PDP 21, is transferred to the frame chassis 22 mounted on the PDP 21 by the thermal conductivity adhesive, and is continuously transferred to the heat sink 26 through the circuit board 23 mounted on the frame chassis 22. In addition, the heat is generated in the circuit board 23, and is transferred to the heat sink 26 connected to the circuit board 23. In this case, when the circuit element 24 including the heat generating element of the circuit board 23 is further included, the heat generated in the circuit element 24 is transferred to the heat sink 26 mounted on the circuit element 24 through the thermal conductivity rubber 25.

Accordingly, the heat respective generated in the PDP 21, the circuit board 23, and the circuit element 24 is transferred to the heat sink 26 and dissipated to the exterior through the thermoelectric element 27 or the heat pipe 37 having the terminal mounted on the rear surface of the extended part 26a of the heat sink 26 and the other terminal exposed to the outside of the plasma display device through the hole of the cover 28. In this case, it is required to apply a predetermined voltage to the thermoelectric element 27 to operate it, but there is no need to apply any energy to the heat pipe 37.

Particularly, since an operation of the thermoelectric electric element 27 is appropriately controlled according to a temperature change in the plasma display device when the temperature sensor (not shown) is provided in the plasma display device, power consumption for operation the thermoelectric

element 27 may be greatly reduced.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

[EFFECT OF THE INVENTION]

Effects of the plasma display device according to the exemplary embodiment of the present invention will be as follows.

Firstly, without simply depending on the air circulation in the plasma display device, since the heat is directly dissipated to the exterior by using a thermoelectric element or a heat pipe that is directly exposed to the exterior and has great heat transfer efficiency, heat dissipation efficiency of the plasma display device is greatly improved, reliability of the circuit elements is guaranteed, and the life span thereof may be increased.

Secondly, since predetermined heat dissipation efficiency may be achieved without using a fan for appropriately circulating the air in the plasma display device, the noise caused by operating the fan is eliminated, so a pleasant watching environment may be provided.

Thirdly, since the thermoelectric element or the heat pipe has a quick response to the temperature change, the heat in the plasma display device may be quickly dissipated.

Fourthly, since the thermoelectric element may actively react to the

temperature change in the plasma display device in cooperation with the temperature sensor when the temperature sensor is provided in the plasma display device, the power consumption for operating the thermoelectric element may be greatly reduced.

(57) 【CLAIMS】

【Claim 1】

A plasma display device comprising:

a plasma display panel (PDP);

a frame chassis mounted on the PDP;

at least one circuit board mounted on the frame chassis;

at least one heat sink connected to the respective circuit boards;

a cover for covering the respective components; and

at least one thermoelectric element having a terminal mounted on the respective heat sinks and another terminal exposed to the exterior through the cover.

【Claim 2】

The plasma display device of claim 1, further comprising a temperature sensor mounted between the circuit board and the cover and electrically coupled to the thermoelectric element.

【Claim 3】

The plasma display device of claim 1, further comprising at least one circuit element electrically coupled to the respective circuit boards, mounted on the respective heat sinks, and having a heat generating element among constituent elements of the circuit board.

【Claim 4】

The plasma display device of claim 3, wherein the respective circuit elements are mounted on the respective heat sinks by using a thermal conductivity rubber.

【Claim 5】

A plasma display device comprising:

a plasma display panel (PDP);

a frame chassis mounted on the PDP;

at least one circuit board mounted on the frame chassis;

at least one heat sink connected to the respective circuit boards;

a cover for covering the respective components; and

at least one heat pipe having a terminal mounted on the respective heat sinks and another terminal exposed to the exterior through the cover.

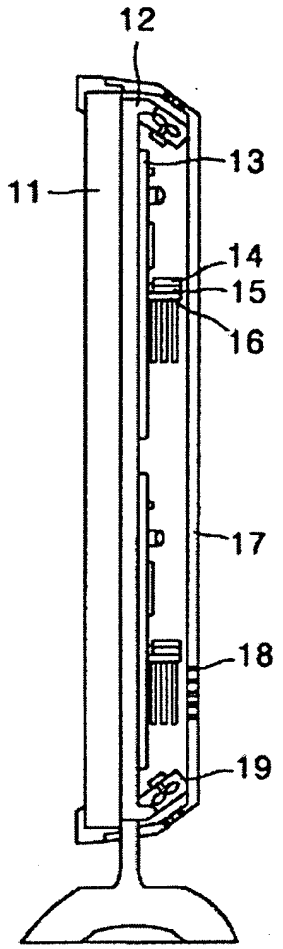
【Claim 6】

The plasma display device of claim 5, further comprising at least one circuit element electrically coupled to the respective circuit board, mounted on

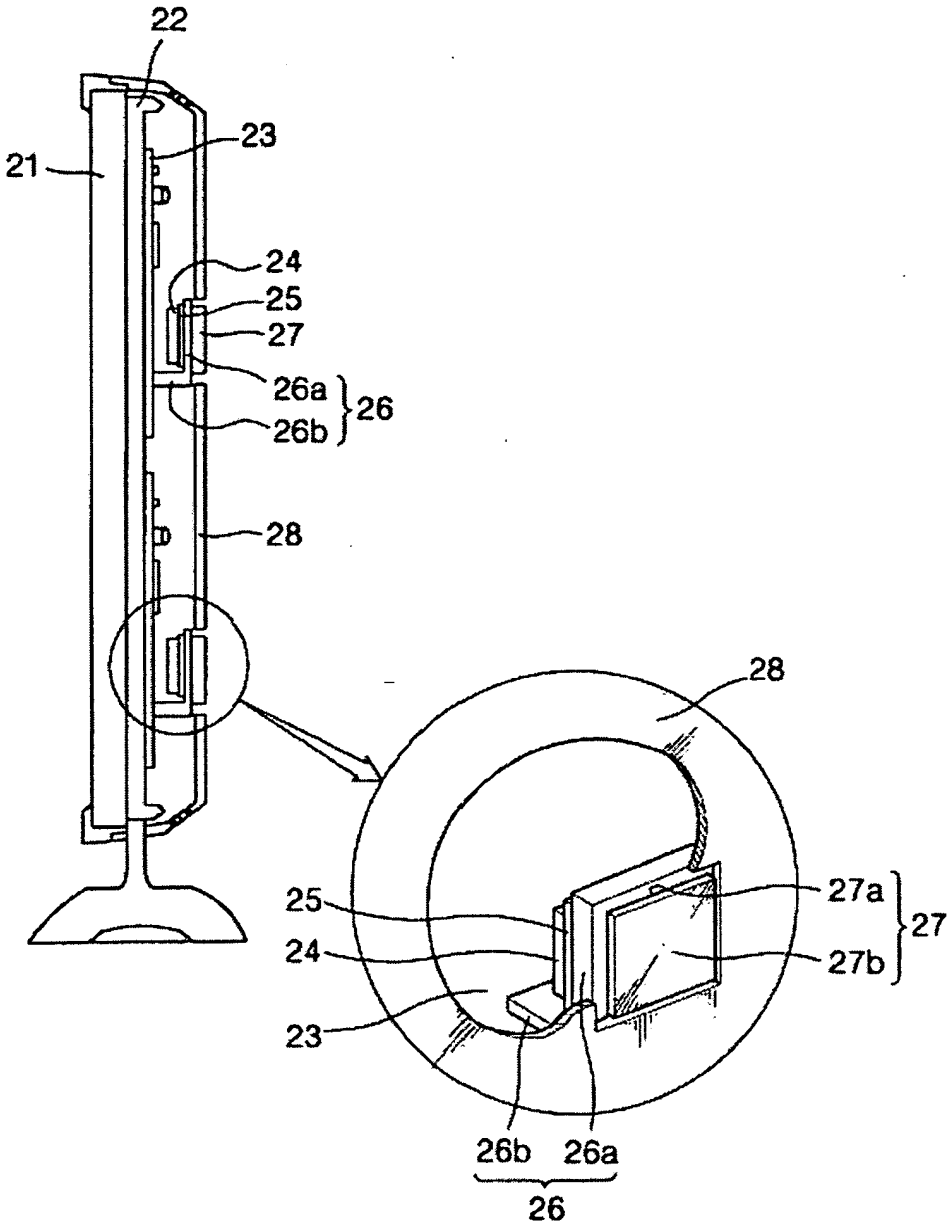
the respective heat sinks, and having a heat generating element among constituent elements of the circuit board.

【DRAWINGS】

【FIG. 1】



【FIG. 2】



【FIG. 3】